3. COAL AND PETROLEUM

Do you know Ram? He is my neighbour who is studying in 8th standard. He goes to school by bicycle. His father goes to office by car. His brother goes to college by bus. Ram's family cooks food using a gas stove.

What are the fuels used in the various modes of transport and for cooking by Ram's family in the above activity? Car uses petrol and the bus uses diesel for cooking LPG (Liquefied Petroleum Gas)

ACTIVITY 3.1 **I DO**

I tabulate the vehicles that use (i) Manpower (ii) Fuel








Manpower	Fuel

Fuels

"Substances that burn in air to give heat energy are called fuels"

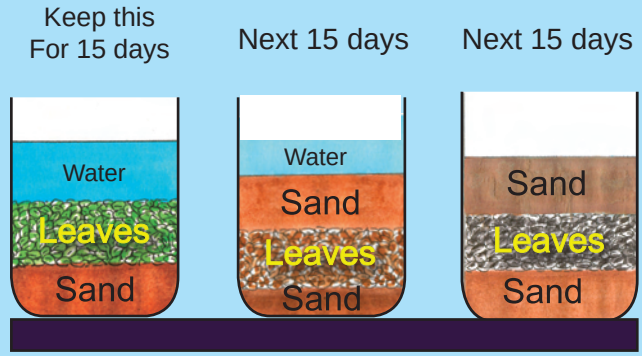
Fossil Fuels

Fossil fuels are formed from the buried remains of decayed plants and animals over millions of years, under the influence of heat and pressure in the absence of air. Coal, petroleum and natural gas are called fossil fuels.

SCIENCE

ACTIVITY 3.2 **I DO**

I need : a glass beaker, sand, water, leaves, twigs pieces of fern



Procedure :

- I take a glass beaker and I spread two inches of sand at the bottom. I pour some water and drop leaves, twigs and pieces of fern on the sand.
- I allow it to stand for two weeks. I note down the change in colour after two weeks.Now I gently put some sand on the top of the plant layer to a depth of two inches.
- I wait for two more weeks and drain the water. Again I allow it to dry for another two weeks.
- I can see the fossil imprint between the sand layers.

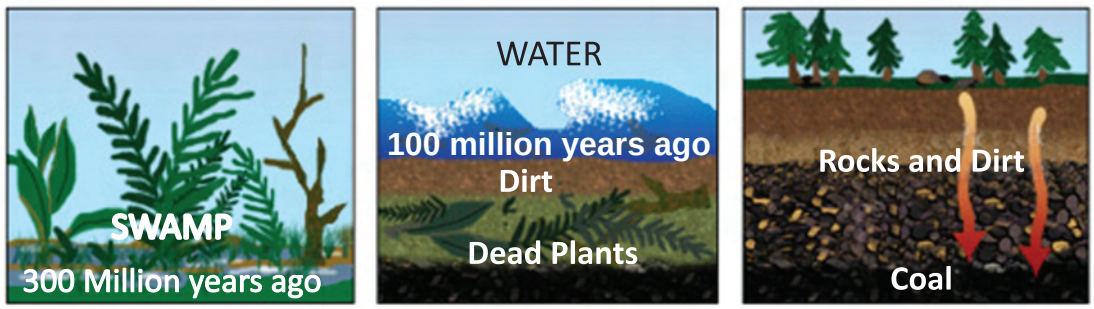
SCIENCE

3.1. COAL

Occurence of coal

Coal mining was started in India in 1774. India now ranks third among the coal producing countries in the world. USA and China have ⅔ of the world's coal reserve.

Three hundred million years ago, some plants grew into giant ferns and mosses. These plants got buried into the bottom of the soil and were converted as fossil due to high temperature and pressure. The decaying plants were pressed and coal was formed. As coal contains mainly carbon, the slow process of conversion of dead vegetation into coal is called carbonisation.



MORE TO KNOW

- Coal would have a higher sulphur content if it was formed in swamps covered by sea water.
- Combustion is caused by the chemical reaction of hydrocarbon with oxygen. When ignited, the fuel molecules are broken down and release heat energy.

COMPOSITION OF COAL:

Coal is a natural black mineral, which is a mixture of free carbon and compounds of carbon containing hydrogen, oxygen, nitrogen and sulphur.

3.1.1. Types Of Coal

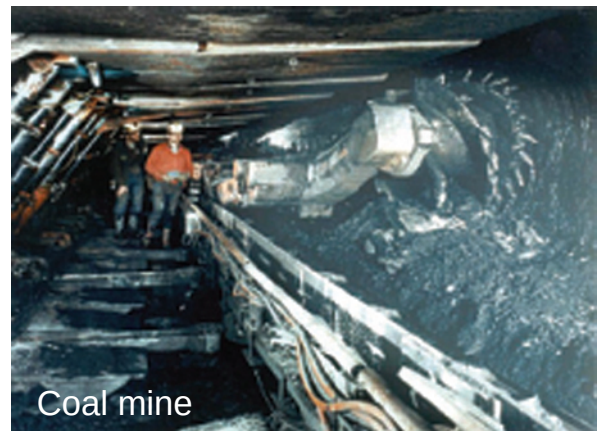
On the basis of carbon content, coal is classified into the following types:

1.PEAT: Peat is the first stage of coal. It is the most inferior variety of coal which contains 10-15% of carbon. When it is burnt, it produces a lot of smoke.

2.LIGNITE: Lignite is brown in colour. It contains 25-35% of carbon. Like peat it also produces a lot of smoke on being ignited. It can be used for power generation.

3.BITUMINOUS COAL: It is also called soft coal. It contains 45-86% of carbon. It is used as a common household fuel and industrial fuel.

4.ANTHRACITE COAL: It is also called hard coal. It is one of the most superior variety. It contains 87-97% carbon. It produces high heat energy.


Coal mine


Peat


Lignite


Bituminous


Anthracite

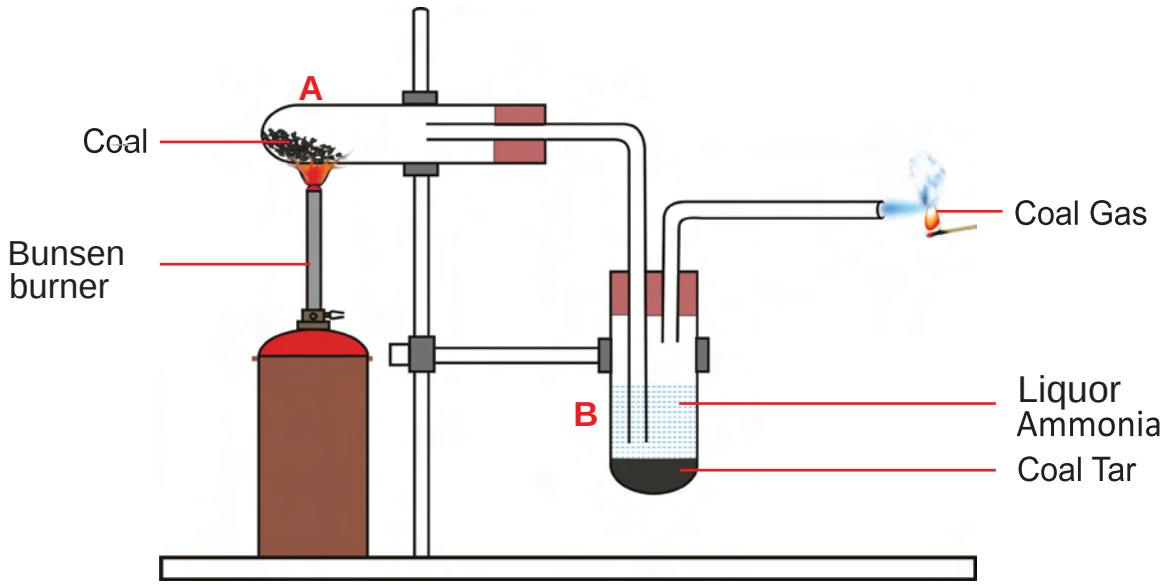
3.1.2 Destructive distillation of coal

Heating coal in the absence of air is called destructive distillation of coal.

ACTIVITY 3.3 **WE OBSERVE**

We need: Powdered coal, two boiling tubes, two delivery tubes, a Bunsen burner, a one holed rubber cork, a two holed rubber cork and some water.

Procedure: Two boiling tubes are taken powdered coal is taken in tube 'A', and water is taken in tube 'B'. The apparatus is arranged as shown in the figure. Tube 'A' is heated first gently and then strongly using Bunsen burner. Now what do we observe?



1. A gas escapes through the delivery tube from the test tube B. On ignition the gas_____. This shows that the gas liberated is coal gas.
2. We can see a _____coloured residue at the bottom of the test tube B. That black residue is coal tar.
3. Now, we take out the liquid present above the coal tar and test it with red litmus paper. Since the liquid turns red litmus paper to _____, it is basic. We smell the liquid, it has a pungent irritating smell. Hence, the liquid obtained is liquor ammonia.
4. We observe a _____ residue in the tube A. The residue is coke.

Our findings: When coal is subjected to destructive distillation it gives coal gas, liquor ammonia, coal tar and coke.

Products of coal and their uses

Products of coal	Uses
Coal Gas	As a fuel in cooking food
LiquorAmmonia	To make fertilizers
Coal Tar	To make plastics, paints, dyes,naphthalene balls and explosives
Coke	As a fuel and as a reducing agent in steel manufacturing

MORE TO KNOW

On destructive distillation, 1000 kg of coal gives

- 700 kg of coke
- 100 litres of ammonia
- 50 litres of coal tar
- 400 m^3 of coal gas

- The world's first petroleum well was drilled in Pennsylvania, USA(1859.)
- Eight years later in 1867,oil was struck at Makum in Assam

Consumption of Coal : The coal that we consume in one day is what the earth took 1000 years to form.The amount of coal we consume is greater than the amount that we produce.

3.2. PETROLEUM

Millions of years ago, dead plants and animals were buried at the bottom of the sea. They got covered with layers of sand and clay. Due to high pressure and temperature, they transformed into petroleum.

3.2.1. Occurrence of Petroleum

The chief petroleum producing countries are U.S.A Kuwait, Iraq, Iran, Russia and Mexico. In India, petroleum is found in Assam, Gujarat, Maharashtra(Mumbai), Andhra Pradesh (Godavari and Krishna basin) and Tamil Nadu (Cauveri Basins). Petroleum is obtained by drilling through the earth.The crude oil is pumped out from the well as a black liquid.

3.2.2 Refining of crude petroleum

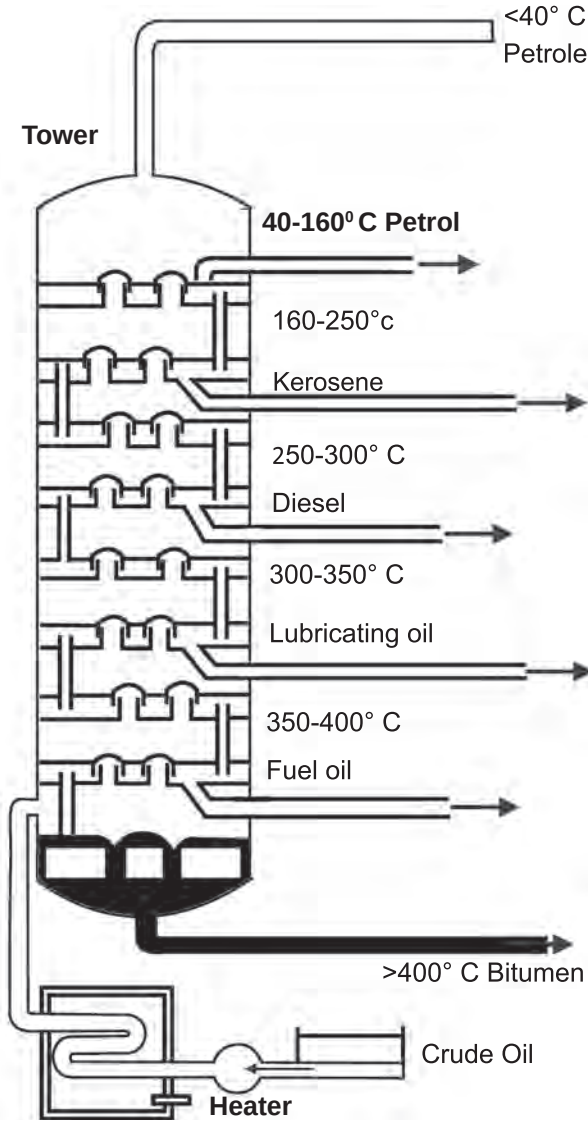
Petroleum is a mixture of various constitutents such as petroleum gas, petrol, diesel, kerosene, lubricating oil, paraffin wax, etc. The process of separation of the various constitutents or fractions of petroleum by fractional distillation in fractionating columns is known as refining of petroleum. The

Petroleum and Natural Gas Formation

SCIENCE

process of heating a mixture of liquids having different boiling points and then separating them by cooling is called fractional distillation.

Crude petroleum is first heated to about 400° C in a furnace. As the vapours of crude oil move up the tower, the various fractions condense according to their boiling point ranges. The various fractions of petroleum obtained are tabulated below;



Fraction	Uses
Petroleum Gas	Fuel for home (LPG)
Petrol	Motor fuel
Kerosene	Fuel for stove and jet aircrafts
Diesel	Fuel for heavy motor vehicles
Lubricating oil	Lubrication
Fuel Oil	Fuel for Power Stations and Ship
Paraffin wax	Candles, Vaseline
Bitumen	Paints, Road surfacing

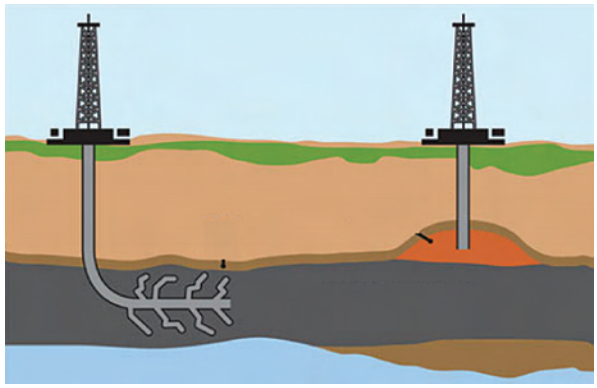
MORE TO KNOW

Many useful substances are obtained from petroleum and natural gas. These are termed 'Petrochemicals. These are used in the manufacture of detergents, fibres, and other man-made plastics like polythene. Hydrogen gas obtained from natural gas, is used in the production of fertilizers. Due to its great commercial importance, pertoleum is also called 'black gold'.

MORE TO KNOW

If we use petroleum rapidly as we do now, in the year 2,050 there may be no petroleum at all.

3.3. NATURAL GAS



Manali

Formation of Natural gas

Natural gas is formed whenever vegetation decomposes in marshy areas and waste sewages. It also occurs in coal mines and petroleum wells.It mainly contains 90% methane.

Neyveli

3.3.1. Occurence

Naturalgas in Tripura, Rajasthan, Maharashtra, Andhra pradesh (Krishna, Godavari Basins) and Tamilnadu (Cauveri Delta.)

ACTIVITY 3.4 **I DO**

I need : A glass bottle, leaves, twigs, waste paper and saw dust

Procedure: I take a glass bottle and put some leaves, twigs, waste paper and saw-dust in it. I pour some water in it and keep it for 20 days. I open the bottle and bring a glowing splinter near the mouth. I can see a gas burning near the mouth.

My finding: The burning gas is due to the evolution of natural gas.

The way of using natural gas

1. CNG (Compressed Natural Gas)
2. LNG (Liquified Natural Gas)

CNG is stored at high pressure whereas LNG is in ultra cold liquid form. CNG can be produced at lower cost.

Advantages and uses of CNG

1. It is a less pollutant fuel.
2. It is directly used as fuel for burning at home and factories.
3. It is the basic material for the manufacture of a number of chemicals and fertilizers.

SCIENCE

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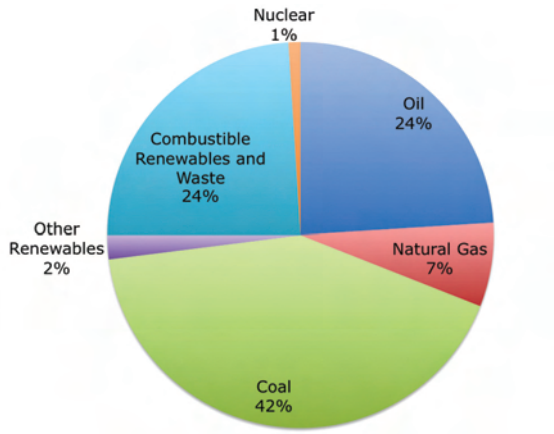
3.4. NATURAL RESOURCES AND LIMITATION

The natural resources in the world have been used by man in a rapid way and so very soon all our exhaustible sources like coal, petroleum and natural gas would be reduced to zero level. So we need to find new alternative sources of energy.

Natural Resources	Lasting period
Coal	148 years
Petroleum	40 years
Natural Gas	61 years

3.4.1. Alternative sources of energy

1. Biodiesel : Biodiesel is a fuel obtained from vegetable oils such as Soyabean oil, Jatropha oil, Cornoil, Sunflower Oil, Cotton seed oil, Rice bran oil and Rubber seed oil.



Energy sources in usage

Not for fun

- My father rode on a cart.
- I drive a car.
- My son flies a jet plane. His son will ride on a cart.

2. Wind Mills : All of you might have seen wind mills. They have long blades connected to a dynamo. When wind blows, they rotate and current is produced in the dynamo. Wind mills are mostly located at Kayathar, Aralvaimozhi, Palladam and Kudimangalam in TamilNadu.

3. Solar Energy : Sun is the foremost energy source that makes life possible on our earth.Solar energy has been used by man from ancient times. Solar energy is harnessed using (i) solar cookers (ii) solar water heaters (iii) solar cells.

4. Gobar Gas: Gobar gas is obtained by the fermentation of cow dung in the absence of air (anaerobic conditions). It mainly contains methane and a little ethane. It is widely used in rural areas for cooking and operating engines.

3.5. SCIENCE TODAY

3.5.1. Hydrogen - The future fuel

Hydrogen could be the best alternative fuel. It is a clean fuel as it gives out only water while burning. Moreover, it has the highest energy content. It does not pollute air.

3.5.2. Cold Fusion Process

Nuclear fusion is a process in which two or more lighter nuclei of atoms are combined to produce nuclear energy. This process requires very high temperature. If the nuclear fusion process is carried out at room temperature, it is called as cold fusion process.

3.5.3 Methane from sewage

Sewage sludge can be decomposed by microorganisms to produce methane gas along with impurities like carbon dioxide and hydrogen sulphide. After removing these impurities, methane gas can be used as an efficient fuel.

MORE TO KNOW

In India, the Petroleum Conservation Research Association(PCRA) advises people with methods of saving petrol/diesel while driving.

Some tips:

- Drive at a constant and moderate speed as far as possible.
- Switch off the engine at traffic signals or at places where you have to wait.
- Ensure correct tyre pressure.
- Ensure regular maintenance of the vehicle.

"Today's wastage - tomorrow's shortage"

"A mile we walk we save a litre of petrol and a day of life"

SCIENCE

EVALUATION

I.Choose the correct answer :

1. Which type of coal has high content of carbon?

a) lignite b) peat c) bituminous coal d) anthracite coal

2. Which type of coal is used in the household?

a) lignite b) peat c) bituminous coal d) anthracite coal

3. Naphthalene ball is obtained from

a) coal gas b) coke c) coal tar d) liquor ammonia

4. Fuel that is used in jet air craft

a) petrol b) petroleum gas c) kerosene d) diesel

5. Which of these is a fossil fuel?

a) wood b) paper c) petroleum d) phosphorus

II. Fill in the blanks:

1. The expansion of LPG is _____.
2. LPG is stored in _____ form in the gas cylinder.
3. The expansion of CNG is _____.
4. The chief element in coal is _____.
5. Natural gas contains mainly _____.
6. Heating in the absence of air is called _____.
7. _____ is the primary source of energy.
8. The coal obtained in Neyveli is _____.
9. The process of separating individual liquids, from the mixture of liquids which differ in their boiling point is called _____.
10. _____ is used as a reducing agent in steel manufacturing.

III. Answer the following ;

1. Ram's family cooks food quickly as they use LPG gas. Murugan's family takes a longer time to cook food. What could be the reason?

2. Find the relevant pair :

   a) Coal - coal gas; then petroleum - _____

   b) LPG - propane and butane; then natural gas - _____

   c) Diesel - petroleum; then bio-diesel - _____

3. Read the following tabular column carefully and decide which fuel we should use for cooking.

Wood	L.P. Gas
Smoke is produced	Smoke is not produced
Has low calorific value	Has high calorific value
It takes a long time to cook	It takes less time to cook
Ashes are formed	Ashes are not formed

4. What do you understand by the term carbonisation?

5. Point out the difference between coal and coke.

6. Distinguish between petroleum and petrol.

7. The boiling point of three components A, B and C of petroleum are 120°C, 70°C, 250°C respectively. If a mixture of these three is fractionally distilled, which of these will be obtained at the bottom of the distillation column?

8. Coal, petrol, diesel and LPG are the fuels used by us now. If they are harnessed completely we would be running short of fuels for cooking and using vehicles and working of factories in our near future. So, we need alternative sources of energy. As a young scientist suggest a source of alternative energy.

9. Types of coal and the percentage of carbon in each type is given below. Which type should be used to get high heat energy?

   Lignite - 25 to 35% carbon
   Bituminous - 45 to 86% carbon
   Anthracite - 87 to 97% carbon

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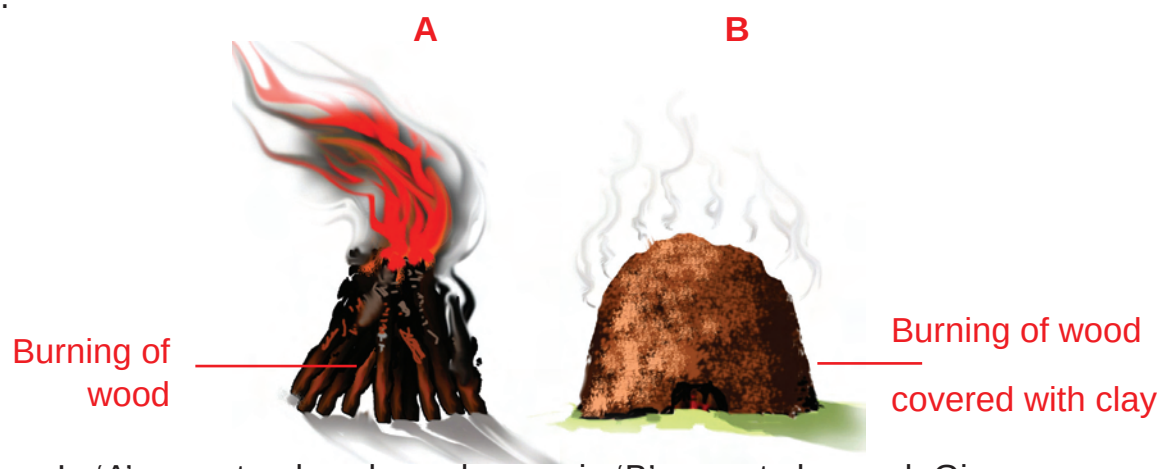
IV. Explore:

1. Countries like Dubai, Saudi Arabia, Abu Dhabi etc. have become very rich in recent years. What could be the reason?
2. Why do millions of people turn off their lights on Earth Hour at 8.30pm (20:30 local time) on the last Saturday of March every year ?
3. 

   In 'A' we get only ashes whereas in 'B' we get charcoal. Give reason.

4. You might have read news items such as the one given below.

Worker dies in septic tank, court ban flouted again

Daniel P George | TNN

Chennai: A 29-year-old man died after inhaling toxic fumes while cleaning a septic tank in a house at Adambakkam on Thursday morning. This is the fourth death of workers involved in manual scavenging, which has been banned by the Madras high court, in the city

out masks or any safety gear. Though the government claims it has abolished scavenging, the practice continues.

"The drainage system should be redesigned and people should be prevented from disposing plastic waste in sewage lines," said Narayanan. "If these steps are taken, workers will not have to enter man-

What is the reason for the tragedy? List out the precautionary measures.

5. Workers in coal mines use battery operated torch lights instead of lanterns. Find out the reason for doing so.
6. If we identify the leakage of LPG in our kitchen, what measures should we take? (make use of the nearest gas dealer)
7. LPG can be lit with a gas lighter whereas wood can not be lit using a gas lighter, why is it so?

V. Field Trip :

1. Pay a visit to the Neyveli coal mine.
2. Pay a visit to the Manali Petroleum Refineries(CPCL).

VI. Choose any one of the following projects that you like most. Complete the project and submit it for FA(a)

1. Collect various petroleum products and display them in your class. (any five)
2. Prepare posters regarding the importance of alternative energy sources. (any two)
3. Prepare slogans for spreading awareness of saving fuel.(any five)
4. Construct a working model of a windmill (Group work).
5. Explore the constituents present in coal gas, producer gas and water gas and find their applications by refering to books or by browsing the internet.
6. Find out the consumption of petrol/diesel/CNG/LPG/kerosene and electricity in your house. Calculate your monthly household expenditure on fuel and electricity. Suggest to your family the measures to be taken to conserve energy.
7. Find out the different types of petrol and diesel that are available at the petrol bunk. What is the composition of each product? Is there any difference in the price of these products ?

FURTHER REFERENCE

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Webliography

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4. LIGHT AND SOUND

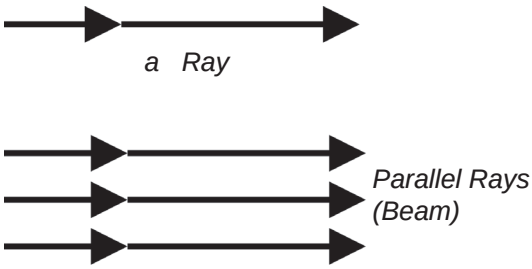
INTRODUCTION

Meera and her friends were enjoying themselves on a picnic. They had a wonderful time visiting new places. Suddenly Meera felt a flash of light falling on her face. where did that light come from? She looked around and saw her friend holding a mirror in her hand and the light seemed to be coming from the mirror.

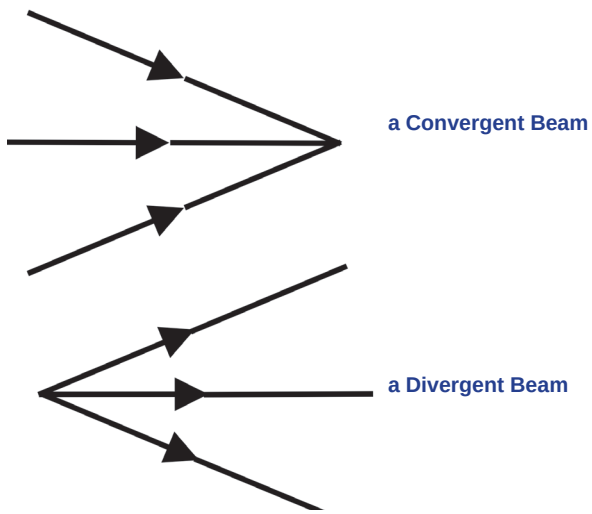
Her friend explained that she was directing the sun's rays to Meera's face with the help of the mirror

Reflection of Light

The bouncing of light from the surface of a body is known as **reflection.** Everything that is around us is seen with our eyes because of the phenomenon of reflection of light.



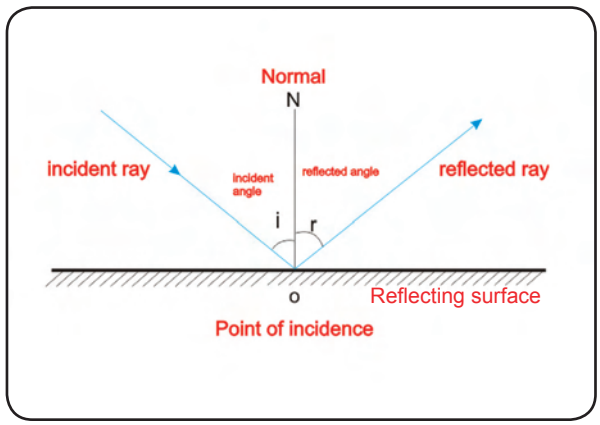
Light travels along a straight line. The path taken by the light is known as a ray and is represented by a straight line with an arrow mark. The arrow mark denotes the direction of the light.



Two or more rays form a beam. When the rays are parallel. It is known as parallel beam.

If the rays meet at a point (converge), they form a convergent beam. If the rays move away from a point it is called as divergent beam.

SCIENCE



A light ray which strikes the surface is called an **incident ray.**

The light ray that comes out from the reflecting surface after reflection is called **a reflected ray.**

The perpendicular line drawn to the surface at the point of incidence is called a **normal.**

The angle between the incident ray and the normal at the point of incidence is called the **angle of incidence (i).**

The angle between the reflected ray and the normal drawn from the point of incidence is called the **angle of reflection (r).**

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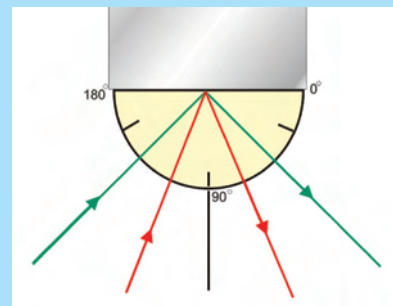
ACTIVITY 4.1 I DO

I need : Drawing sheet, a protractor, a plane mirror, torch light.

procedure :



I arrange the drawing sheet, protractor and a plane mirror as shown in the diagram.

- Using the protractor I draw a normal at a point.
- Then I draw the number of lines at different angles.
- From the torch light, I make a ray of light to pass along a line and draw the path of the reflected ray. I measure the angle of reflection.
- I repeat the experiment for different angles of incidence and I measure the corresponding angle of reflection and tabulate the measures.

S.No	∠i	∠r

My finding: _____

Inference

1. The incident ray, the normal and the reflected ray lie in the same paper plane.
2. The angle of incidence = the angle of reflection.

4.1. LAWS OF REFLECTION

1. The incident ray, the reflected ray and the normal to the surface at the point of incidence lie in the same plane.
2. The angle of incidence is equal to the angle of reflection.

$$\angle i = \angle r$$

ACTIVITY 4.2 **WE DO**

We need : wood, window panes, table tops, polished granite surfaces, paper.

procedure :

- Let us look ourselves through the surface of all these objects.

My finding :

_____

_____

_____

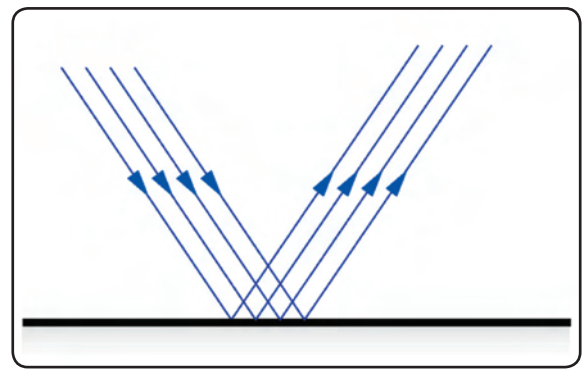
_____

From this activity, We see that we can see our face clearly in the polished surfaces and not very clearly in the rough surfaces.

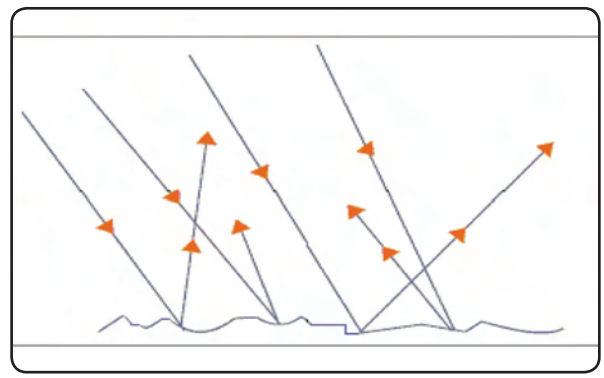
4.1.1. Regular and Irregular Reflections

Reflection from a polished surface is called **Regular reflection**.

Reflection from a rough (unpolished) surface is called **irregular or diffused reflection.**



In the case of a rough surface, light is not reflected in one direction, it is scattered in all directions. This is called a diffused or irregular reflection.

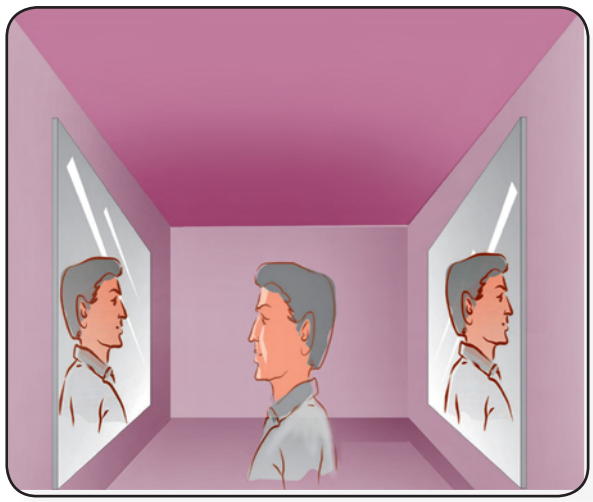


SCIENCE

4.1.2. Multiple reflection

When we enter into a jewellery shop, a barber's shop, a hotel or a bakery, can we see a number of images in the mirror?

How does this happen? It is just a trick using the mirror.



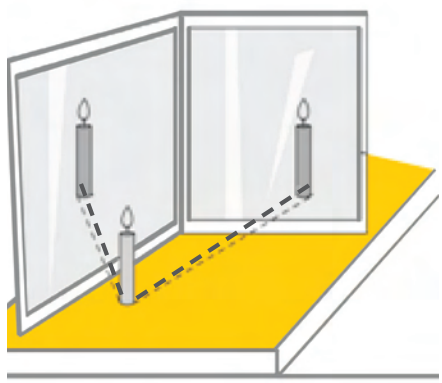
The mirrors are arranged at a particular angle so as to get the maximum number of images. Have you ever tried to look at the back of your head in a mirror? Two plane mirrors are needed to see the back of our head as shown in the figure. This is due to multiple reflection.

4.1.3. Multiple Images

We are aware that a plane mirror forms only a single image of an object.

But two or more mirrors are arranged to form number of images of an object. These are called Multiple Images.

ACTIVITY 4.3 — I DO



Multiple reflections and Multiple Images

I need : plane mirrors, a candle.

procedure :

- I keep a burning candle before a plane mirror.
- I hold another plane mirror at an angle to the first mirror.Then I count the number of images formed.
- I do the same by keeping the mirrors at different angles and I count the number of images formed.

ACTIVITY 4.4 **WE DO**

We need : two mirrors, cellophane tape.

procedure :

- We form five different groups. Each group is provided with two mirrors.
- By using cellophane tape, we fix the mirror at a particular angle say 30^0.
- Then we place the object in between the mirrors and we count the number of images formed.
- We repeat the experiment for different angles and in each case we count the number of images formed.
- We complete the table by observing the number of images formed.

Angle	Number of images
30^0	
45^0	
60^0	
90^0	

A relation between the number of images and the angle between the mirrors.

$$\text{Number of images} = \frac{360^0}{\text{angle}} - 1$$

When the mirrors are placed parallel to each other, the maximum number of images will be formed.

Multiple reflection principle is applied in the kaleidoscope and periscope.

ACTIVITY 4.5 (*A GARDEN IN A CHALK BOX*) **I DO**

I need : Card board box, plane mirrors, flowers.

procedure :

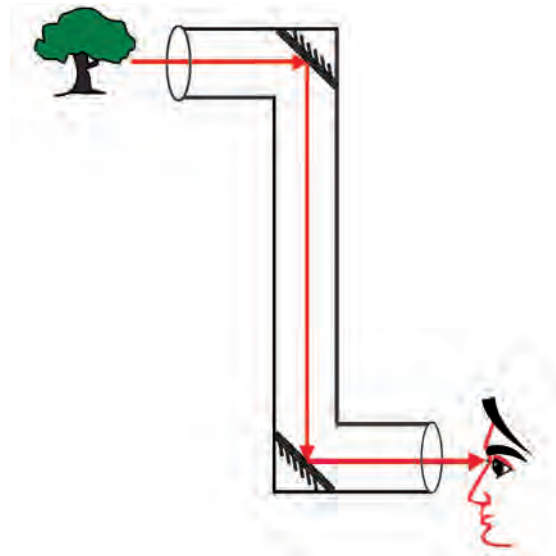
- I place the mirrors on opposite sides of a card board box so that the reflecting surfaces face each other.
- I keep two or three flowers of different colours in the card board box.
- I make a hole on any one of the sides of the box and remove the coating on the mirror in front of the hole. Now I look into the box through the hole.
- I repeat the experiment by keeping the mirrors on all sides of the box.

My finding : Multiple images of the flowers like a garden due to multiple reflection.

Mirror Periscope

The working of a periscope is based on the principle of successive reflections from two plane mirrors. It consists of two plane mirrors facing each other fixed at 45^0 to the frame work of a tube.

Fix the two mirrors at an angle of 45^0 as shown in the figure. View an object through one end.



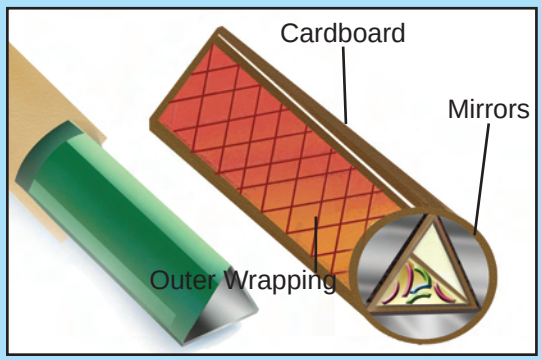
ACTIVITY 4.6 **I DO**

I need : Three equal mirror strips, pieces of broken bangles,a cardboard.

procedure :

- I take three equal sized mirror strips and join them as shown in the figure.
- I fix them in a circular cardboard tube.
- I close one end completely.
- I place a few pieces of broken bangles between the mirrors.
- I close other end of the tube having a hole in the centre through which I can see.

My finding : multiple images due to multiple reflection.



Kaleidoscope

4.2. REFRACTION

ACTIVITY 4.7 **I DO**

I need: a glass beaker, a pencil.

procedure :

- I take a glass beaker and place a pencil inside it.
- I look at the pencil. It appears straight.
- I add water to the beaker slowly and look at the pencil from the sides.
- The pencil now appears to be bent after water was poured into the beaker.

Why does this happen? Let us find out.

The path of light seems to have changed before reaching our eyes. We call this phenomenon deviation.

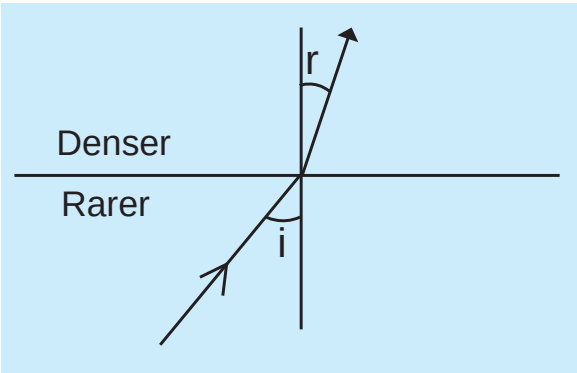
From the above activity we see that the pencil appeared bent when there was water and appeared straight when there was only air. Thus we see that the path of light behaves differently when it passes from one medium into another.

This bending of ray of light when it passes from one medium to another is called refraction.

The direction of deviation depends on the densities of the two media. The medium of greater density is known as denser medium. Ex : Glass

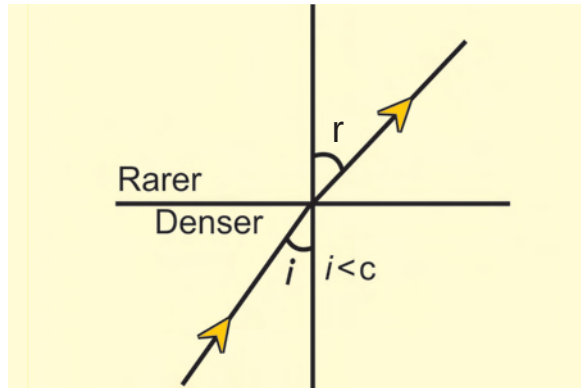
The medium of lower density is known as rarer medium. Ex: Air

1. When light travels from a rarer medium and enters a denser medium, it will be deviated towards the normal.



Ex : From Air to Glass

2. The light will be deviated away from the normal when it passes from a denser into a rarer medium.



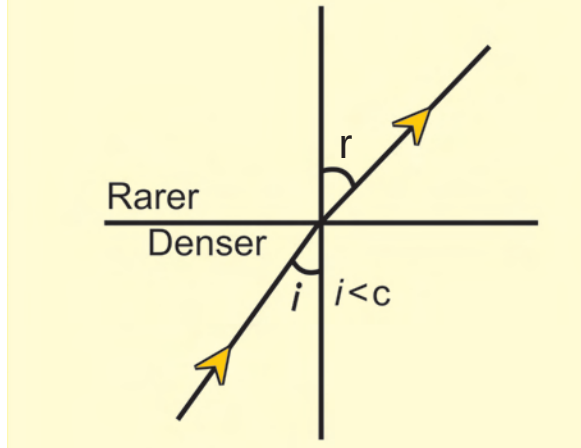
Ex : From Glass to Air

Every day effects of Refraction

1. A fruit appears to be bigger in a glass of water due to refraction.
2. Printed letters appear to be raised when a glass slab is placed over them.
3. A swimming pool appears more shallow than its actual depth.

4.3. TOTAL INTERNAL REFLECTION

Consider a ray of light passing from a denser medium to a rarer medium.

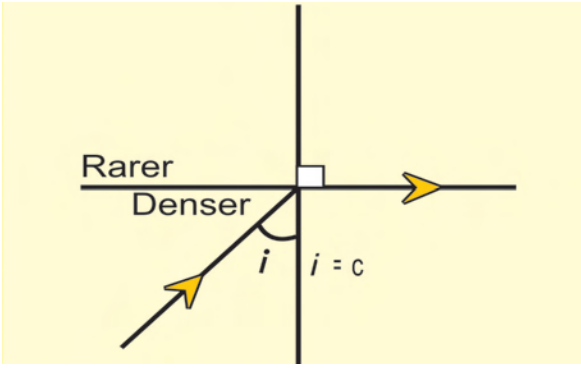


When a ray of light passes from a denser medium to a rarer medium, the refracted ray is bent away from the normal.

SCIENCE

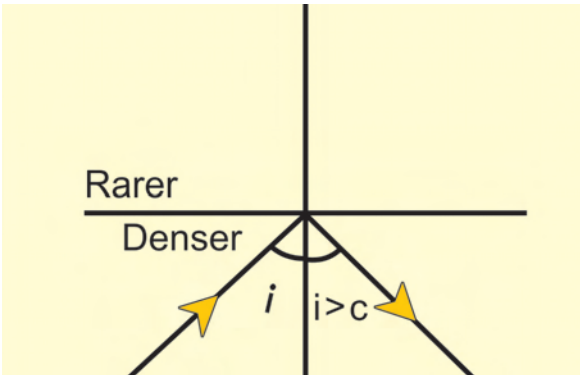
As the angle of incidence increases, the angle of refraction also increases.

At a certain angle of incidence, the angle of refraction becomes 90°. The angle of incidence for which the angle of refraction becomes 90° is called the critical angle C.



If you further increase the angle of incidence, at one point the ray will be completely reflected back into the same medium.

If the angle of incidence is more than the critical angle, the ray bends inside the denser medium itself. This phenomenon is total internal reflection.



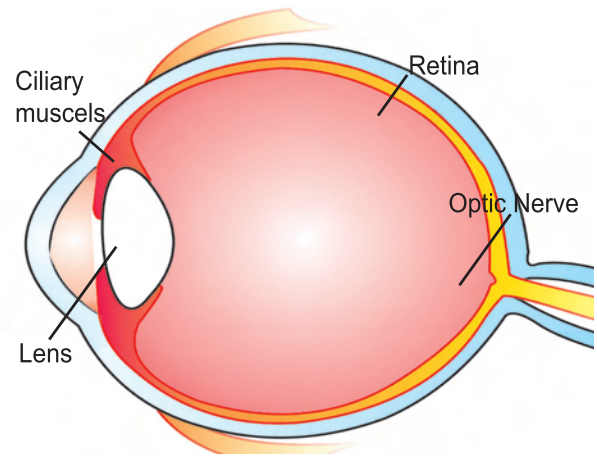
Necessary conditions for total internal reflection

1. The light must proceed from a denser medium to a rarer medium.
2. The angle of incidence in the denser medium must be greater than the critical angle.

4.4. HUMAN EYE

The human eye has a convex lens. The convex lens of an eye forms an image of the object on a screen called the retina. The retina is covered by a large number of nerve fibres(optic fibres) which sensitive to light. They carry the image by means of optic nerves to the brain.

The human eye focusses the image for different objects at different distances by changing the focal length of the lens. This is done by the ciliary muscles, which stretch and relax to change the focal length of the lens. This action of the eye is called the power of accommodation of the eye. The most comfortable distance the normal eye can read is about 25 cm. This distance is called the least distance of the eye. The minimum distance at which the eye can see objects distinctly varies with age.



4.5. SOUND

We hear many types of sounds around us everyday. Each sound is characteristic of the object producing it.

Different sources of sounds around us :

ACTIVITY 4.8 **I DO**

By observing the picture, I list the various sounds produced.

1. _____ 5. _____
2. _____ 6. _____
3. _____ 7. _____
4. _____ 8. _____

Does vibrating objects produce sound?

ACTIVITY 4.9 — I DO

I need : A metal plate, a glass tumbler, a plastic mug, a sheet of paper, a wooden block, a cloth, metal stick.

procedure :

- I collect the above objects.
- I tap all these articles one by one with a metal stick.

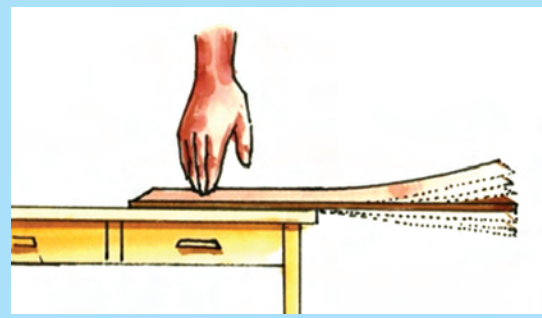
From the above activity we observe that they make different types of sound due to vibration.

ACTIVITY 4.10 — I DO

I need : a table, a scale.

procedure :

- I take a scale and hold its one end firmly on the table with one hand as in the figure.
- I tap the free end of the scale with my other hand.The scale begins to vibrate now.



- When I touch the scale with my finger, it stops vibrating. It doesn't produce any sound now.

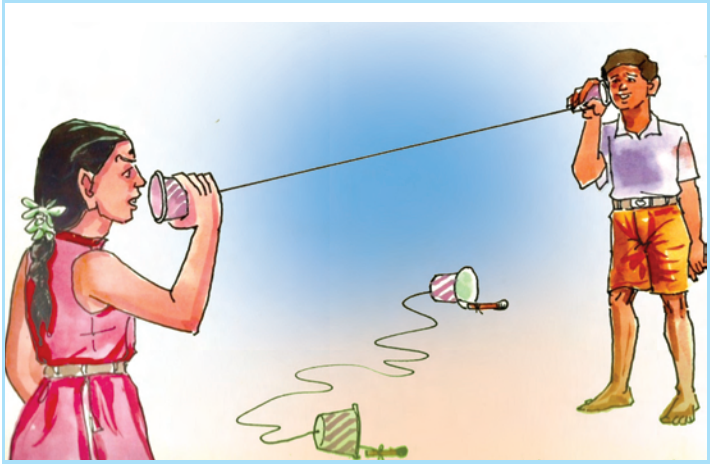
ACTIVITY 4.11 — I DO

- I touch a bell when not in use.
- Now I tap the bell with an iron rod and touch it when it is producing the sound.
- I feel the vibration in my hand.

From the above activities we observe that the vibrating object produces sound.

4.5.1.SOUND NEEDS A MEDIUM FOR PROPAGATION

ACTIVITY 4.12 **WE DO**



We need : Two empty paper cups, a string, matchsticks.

procedure :

- We take two empty paper cups.
- We make a small hole at the bottom of each cup and pass the ends of a string through the holes. We tie the ends to match sticks to hold them in place.
- One of us hold one cup near our ear and ask our friend to speak in other cup.
- What was spoken through one cup was heard clearly in the another cup.

Our finding : Sound can travel through solids.

ACTIVITY 4.13 **I DO**

I need : Two marbles or pebbles, a bucket of water.

procedure :

- I take two pebbles or marbles and beat them together. I listen to the sound.
- I submerge them in a bucket of water then I tap the pebbles together under water.
- I Listen to the sound by keeping my ear near the bucket.
- The sound heard is clearer and louder when the pebbles are submerged in water.

Our finding : Sound can travel through liquids.

When you call your friend Gopal who is standing far away, how could he able to hear your voice? How does the sound travel to Gopal? The reason is sound can travel through Air.

SCIENCE

ACTIVITY 4.14 **WE OBSERVE**

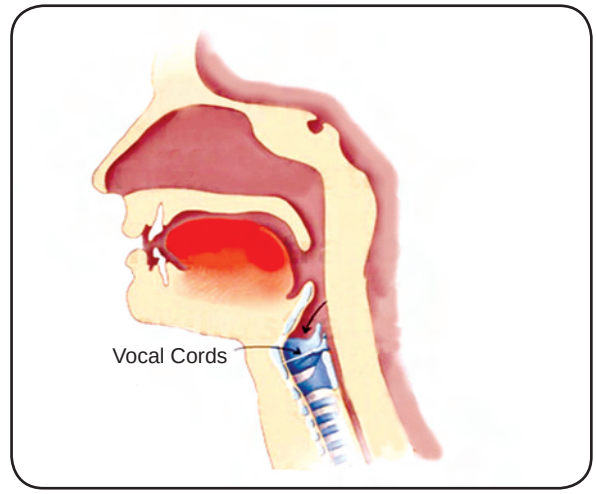
With the help of the vacuum pump when the air is removed from the bell jar gradually, the sound gets feebler. When the entire air is removed from the bell jar and made vacuum, we can not hear the sound from the cell phone. From this we learnt that sound can not travel through vacuum.

Sound needs a medium for propagation. Sound can travel through solid, liquid and gases. It can not travel through vacuum.

Sound plays an important role in our lives. It helps us to communicate with one another. It is difficult to communicate without talking. Every one and everything around us produce sounds.

4.5.2. Sound produced by humans

Speak loudly or sing a song or buzz like a bee. What helps to do this activity?



In human beings, the sound is produced by the “voice box” or the larynx. The voice box has two “vocal cords”. They are stretched across the voice box in such a way that there is a narrow slit between them for the passage of air. When we speak, the lungs force air through the slit and the vocal cords vibrate, producing sound.

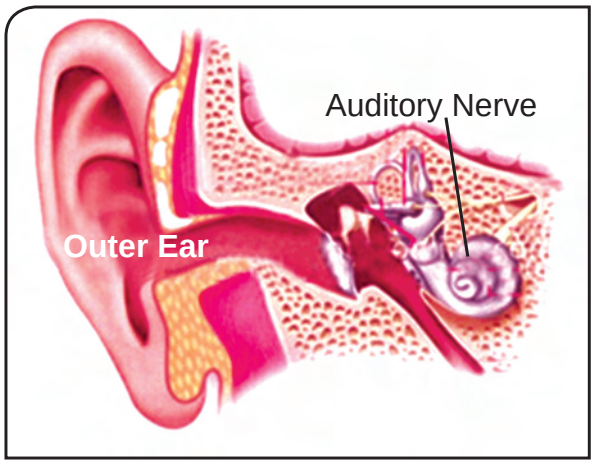
MORE TO KNOW

The vocal cords in men are about 20 mm long. In women, these are about 15 mm. Children have very short vocal cords.

4.5.3. Human ear and hearing

How do we hear sounds?

We know that vibrating objects produce sound which is carried in all directions through a medium. Our ears help us to hear sounds. The human ear has three important parts. Only one of its parts can be seen and felt by you, which is the outer ear.



The outer ear consists of the pinna and the ear tube. The shape of the outer part of the ear is like a funnel. When sound enters the ear, it travels down a canal at the end of which a thin membrane is called **"ear drum"** stretched tightly. It performs a very important function.

The middle ear has three tiny interlocked bones. The inner ear has a coiled organ of semi circular canals and the auditory nerve.

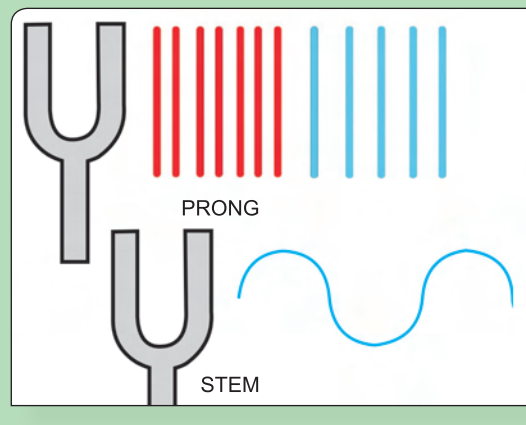
A vibrating body causes air molecules to vibrate. These vibrations reach our ear and are collected by the pinna and then funnelled into the ear tube. The vibrations strike the eardrum and start vibrating. The ear drum sends the vibrations to the inner ear. From there the signal goes to the brain. That is how we hear sounds.

We must never put a sharp or hard object into our ear. It can damage the eardrum. A damaged eardrum can impair hearing.

4.5.4. Amplitude, Time period and frequency of a vibration

You have learnt that to and fro motion of an object is called frequency. A tuning fork is made of steel. The two upper ends of the tuning fork are called the 'prongs', while the lower end is called the 'stem'.

Strike the prongs against a hard rubber pad and observe the vibrations. A vibrating tuning fork produces sound.



SCIENCE

ACTIVITY 4.15 **I DO**

I need : Two rubber strips of the same length and width.

procedure :

- I take two rubber strips of the same length and width.
- I put them one above the other.
- I hold them at both ends and stretch them tight.
- I blow air through the slit between them.
- A sound is now produced.

Frequency (n): The number of oscillations per second is called the frequency. Frequency is expressed by hertz – Hz

Time period (T): The time taken by the vibrating body to complete one vibration or oscillation is called the time period. The unit of period is second(s).

Amplitude (a): The maximum displacement of a vibrating body from its mean position is called amplitude. The unit of amplitude is metre (m)

The relation between frequency (n) and time period (T)

The period of oscillation is the reciprocal of the frequency.

$$\text{Time period (T)} = \frac{1}{\text{frequency(n)}}$$

We can recognize many familiar sounds without seeing the object producing these sounds. How is it possible? These sounds must be different to enable you to recognize them.

- Amplitude and Frequency are two important properties of sound.
- The loudness of the sound depends on its amplitude.

4.5.5. Audible and Inaudible Sounds

The human ear can hear the range of audible frequencies between 20 Hz and 20000 Hz. They are called audible sounds.

Sounds of frequencies lesser than 20 Hz and greater than 20000 Hz can not be heard by the human ear. They are called inaudible sounds.

4.5.6. Noise

Any unpleasant sound is called noise. In the classroom, if all the students speak together, what would the sound produced be termed? It is noise.

On the other hand, we enjoy sound from musical instruments. Musical sound is pleasing to the ear.

4.5.7. Noise pollution

Unwanted sound from any source that causes discomfort of any kind is called noise pollution.

Harmful effects of noise pollution

- Exposure to sudden high noise level can damage to the eardrum.
- High levels of noise can also lead to nervous tension and increase in blood pressure.
- Noise also disturbs sleep, increases stress and causes headache.

MORE TO KNOW

Sound waves of frequencies above 20,000 Hz are called ultrasonic waves. Bats use ultrasonic waves for their flight.

Some animals can hear sounds of frequencies higher than 20000Hz. Dogs have this ability.

Steps to control noise pollution

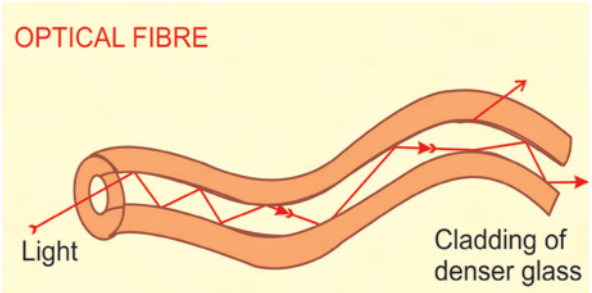
1. The use of loudspeaker in functions should be stopped.
2. Cars and other vehicles should not produce loud sounds.
3. T.V and Musical systems should be listened at low volumes.

4.6. SCIENCE TODAY

An optical fibre is a device based on the principle of total internal reflection.

Optical fibres are thin, flexible and transparent strands of glass which can carry light along them very easily. A bundle of such thin fibres forms a light pipe.

When light is incident at one end of the fibre at a small angle the light that passes inside undergoes repeated total internal reflections along the fibre and finally comes out.



Even if the fibre is bent or twisted, light can easily travel through the fibre. The method of using optical fibres to carry images and messages is called fibre optics.

Uses of optical fibres

1. Optical fibres are used to transmit communication signals.
2. In medicine, optical fibres are used in endoscope and laparoscopes.

ACTIVITY 4.16 **I DO**

I observe the pictures given below and fill up the blanks using the right words, based on the sounds produced. (noise/music)

_____

_____

_____

_____

_____

EVALUATION

I. Choose the best answer:

1. Reflection from a smooth surface is called _____reflection.
   (regular, irregular, multiple, total internal)
2. If the angle of incidence is 40° the angle of reflection is _____
   (10° , 40°, 20°, 90°)
3. The angle between the incident ray and the normal is called _____
   (angle of incidence, angle of reflection, angle of refraction)

II. Fill in the blanks:

1. The working principle of a periscope is _____
2. A fruit appears to be bigger in a glass of water due to _____
3. Sound can not travel in _____
4. When we touch the ringing bell we can feel the _____
5. An audible sound has the frequency range of _____

III. Identify the mistakes and correct them:

1. The beautiful pattern that we obtain in a kaleidoscope is because of refraction.
2. Unwanted sound from any loudspeaker that causes discomfort of any kind is called Music.
3. An optical fibre is a device based on the principle of refraction.

IV. Match the following:

a. Irregular reflection	-	Glass slab
b. Multiple reflection	-	Optic fibre
c. Refraction	-	Periscope
d.Total internal reflection	-	Wood

V. Classify the pairs of media as denser and rarer.

a. Air, water **b. Air, glass** **c. water, glass**

VI. Answer the following.

1. Objects present in the dark room are not visible. But when the light is switched on, everything present in the room becomes visible. why does this happen?
2. Differentiate between regular and irregular reflection.
3. State the laws of reflection.
4. Suggest some measures to reduce noise pollution in your residential area.
5. Your parents are going to buy a new house. They have been offered one on the roadside and another two lanes away from the roadside. Which house would you suggest your parents? List out the ways and means to reduce noise.
6. Extremely loud sound can make one deaf. Suggest some measures to check loud noise.
7. Factories should not be constructed in the residential areas. Do you agree or not ? If so, why ?
8. If Raman fixed two mirrors at an angle of 60 degrees to get as many number of images, could you find out the exact number of images produced ?

   (N=360/angle -1).
9. Veena and Rani are on the moon, Veena calls out her friend, but Rani does not hear Veena's call eventhough she is near. Discuss.

FURTHER REFERENCE

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2. A Second Course in Elementary Physics - C.S. Karve and G.Z. Shah.

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‘I can, I did’

Student’s Activity Record

Subject:

Sl. No	Date	Lesson No.	Topic of the Lesson	Activities	Remarks